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THE GREATER ANTILLEAN SPECIES OF *POLYCENTROPUS* (TRICHOPTERA: POLYCENTROPODIDAE)

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Although the aquatic insects of the West Indies have received increasing attention in recent years, there are still many surprises awaiting to be uncovered by further collecting. For example, the last check list of Antillean Trichoptera (Flint, 1968b, p. 80) listed five species of *Polycentropus* from the Greater Antillean Islands; one each from Puerto Rico, Jamaica, and Hispaniola, and two doubtfully distinct species from Cuba. This then, appeared to be a probable case of one species per island.

On my short trip to the island of Hispaniola in June of 1969 I was delighted to recognize examples of *Polycentropus* coming to the light, and assumed that they represented the known species, *P. domingensis* Banks. Upon further study after my return it was immediately apparent that two species were represented, neither being *domingensis.* My colleagues Dr. and Mrs. D. R. Davis made further collections on the island in May of 1973, resulting in further examples of *Polycentropus.* However, all of these, save one, pertained to a third undescribed species of the genus! As a result I now recognize four species on Hispaniola, but comparison of types has resulted in the synonymy of the two names from Cuba. Undoubtedly more collecting, especially on Cuba, will reveal more unknown species.

As a result of the preparation of the descriptions of these three new species, I became very interested in the evolution and dispersal of what is obviously a monophyletic group in the Greater Antilles. This paper, then, is a summary of the present state of the taxonomy of *Polycentropus* on the Greater Antilles as well as a preliminary exposition of their probable phylogeny and zoogeography.

Genus *Polycentropus* Curtis

This genus is almost worldwide in distribution, although apparently most diverse in the North Temperate Zone. It contained by 1960 nearly 150 species, recent and fossil (especially from the Baltic amber), placed under the several generic names that were lumped by Ross (1944). Until the entire world fauna is studied in a rigorously phylogenetic manner there seems little reason to attempt to place species under *Holocentropus*, *Plectronemia*, or *Polycentropus*.

Regardless of the problems at the generic level, the Greater Antillean species all belong to a single monophyletic group, which I here name the nigriceps group, defined as follows:

> Male. Tenth tergum sclerotized ventrally, with a pair of ventromesal lobes. Cercus variable, but always with a long, slender inner lobe and a broader, flattened outer lobe, and sometimes a third, central lobe between these two. Clasper with a finger-like dorsomesal appendage borne from the dorsal margin of a thin, broad vertical support, that is connected to a more broadly terete ventral lobe. Aedeagus rather lightly sclerotized, tubular; with an internal sclerite, basally terete, and apically rather hookshaped in lateral aspect. Female. Ninth sternum strongly sclerotized and trilobate apically. Vagina with variable lateral plates, generally, a pair of cuplike structures, and a ringlike anteromesal plate with a central opening.

At this time little can be said about the immature stages of this group, although the larvae of *P. jamaicensis* Flint and *P. zaneta* Denning have been figured. These and the larvae of an unknown Hispaniolan species do not show any obvious differences between themselves, nor from most other species of the genus.

The larval habitat, in all the material taken up to now, is in rather slowly flowing reaches and pools, in smaller streams in the mountains and hills. The larval nets have the appearance of "cobwebs" over and between the rocks and stones on the bottoms of the pools. The larvae are found in denser masses of silk on the undersides of the rocks. The pupae are generally found attached to the undersides of the same rocks, partially sheltered in some angle of the rock, within a silk and stone shelter.

Key to adult males

1. Cercus consisting of two distinct lobes (fig. 2, 8) 2
   Cercus consisting of three distinct lobes (fig. 4, 6) 6
2. Outer lobe of cercus bilobate, without area of short, flattened setae
   (fig. 1, 2) (Cuba) .... *nigriceps* Banks

Outer lobe of cercus bilobate to elongate, with inner, ventral area bearing shortened, flattened setae (fig. 7–14) 3

3. Outer lobe of cercus clearly with a basoventral flap (fig. 7, 8) (Hispaniola) ....*domingensis* Banks

   Outer lobe of cercus without a basoventral flap (fig. 9–13) 4

4. Outer lobe of cercus in dorsal aspect with a distinct apicomesal flap; inner lobe without a mesal spinous process (fig. 9–10) (Hispaniola) ....*jeldesi,* new species

   Outer lobe without a distinct apicomesal flap; inner lobe with a mesal spinous process (fig. 11–14) 5

5. Outer lobe of cercus long, tip not directed mesad (fig. 11, 12) (Hispaniola) ....*marcanoi,* new species

   Outer lobe with tip strongly upcurved and directed mesally (fig. 13–14) (Jamaica) ....*jamaicensis* Flint

6. Cercus with two long, slender lobes, and one thin, broad lateral lobe (Fig. 3, 4) (Puerto Rico) ....*zaneta* Denning

   Cercus with 1 long slender lobe, and 2 thinner, broad lobes, central one covered with short, broad setae (fig. 5, 6) (Hispaniola) ....*vanderpooli,* new species

Polycentropus nigriceps Banks

Figures 1–2

Polycentropus nigriceps Banks, 1938, p. 301.—Fisher, 1962, p. 90.—Flint, 1967, p. 6; 1968b, p. 80.

Polycentropus rosarius Kingsolver, 1964, p. 257. (New synonymy).

I have compared the lectotype of *nigriceps* with a paratype of *rosarius.* Although some small differences are apparent these are of the magnitude that appear as variation in other species, or are due to change in orientation or compression of the specimens, etc.

The figures here presented were prepared from the paratype of *rosarius.*

The female is not known with certainty; it is quite probable that it is described below as species 1.

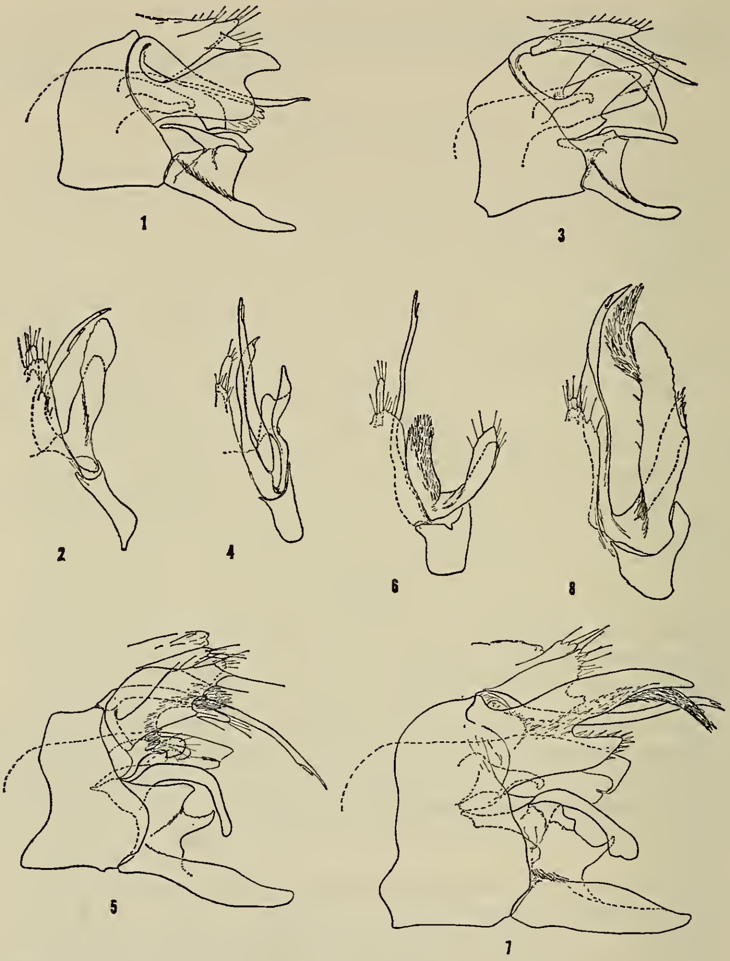
Material: Cuba, Pinar del Rio, Soroa, June 1963, 1♂. Moa, Oriente. 3–16 Nov. 1945, J. Acuña, 1♂ (paratype of *P. rosarius* K., INHS). Cienfuegos, Soledad, Apr. 1936, Darlington, 1♂ (lectotype of *nigriceps*), 1 without abdomen (MCZ).

Polycentropus zaneta Denning

Figures 3–4, 16

Polycentropus zaneta Denning, 1947, p. 660.—Wolcott, 1950, p. 93.—Flint, 1964, p. 32; 1968b, p. 80.—Fischer, 1972, p. 35.

This rather distinct species has been taken only on Puerto Rico. In addition to the rather extensive material recorded (Flint, 1964) from the



Figs. 1–8. Male genitalia lateral, tenth tergum and cercus, right side dorsal, respectively of *P. nigriceps* Bks. 1–2, *P. zaneta* Denn. 3–4, *P. vanderpooli* n. sp. 5–6, *P. domingensis* Bks. 7–8.

island a few more specimens have been taken in recent years. These are from the mountains in the center and west of the island where the species is already well known, and are therefore not recorded here.

New figures have been prepared to facilitate comparison with the other species of the genus.

Polycentropus vanderpooli, new species

Figures 5–6

Although this species is clearly a member of the nigriceps group, it is the most distinctive in the structure of the cerci. Only in *vanderpooli* is there a broad, ear-shaped lobe between the inner, rod-like and outer flattened lobes of the cercus. In addition there are other smaller differences in the shape of the claspers and tenth tergum between this species and the others in the group.

I take pleasure in dedicating this most remarkable new species to Mr. Wynant D. Vanderpool, Jr. for his support of the Smithsonian Institution.

Adult: Length of forewing, 7–8 mm. Color brown; venter, legs and antennae stramineous, head dorsally fuscous; forewings brown with many very small spots of golden hairs scattered overall. Male genitalia: Ninth segment with anterodorsal angle strongly developed, anterior margin strongly sinuate. Tenth tergum lightly sclerotized ventrally, ending in many small lobes; ventromesal lobe long. Cercus consisting of three lobes; inner very long, almost straight; outer, broad and thin, with margins very irregular; central lobe, bilobate with outer face bearing broad, flattened spines. Clasper with dorsal appendage long, apical half angled ventrally; vertical support bearing a strong spine from posterior margin; ventral lobe long. Aedeagus lightly sclerotized, with a central tubular sclerite hooked apically.

Material: Holotype, male: Dominican Republic, Convento, 12 km. south of Constanza, 6–13 June 1969, Flint & Gomez. USNM type 73736. Paratypes: LaPalma, 12 km. east of El Rio, 2–13 June 1969, Flint & Gomez, 31♂. Constanza, 2–6 June 1969, Flint & Gomez, 1♂. La Estrella Prov., 4 km. southeast of Rio Limpio, 760 m. elev., 24–25 May 1973, D. & M. Davis, 1♂.

Polycentropus domingensis Banks

Figures 7–8

Polycentropus domingensis Banks, 1941, p. 399.—Flint, 1967, p. 6; 1968b, p. 80.—Fischer, 1972, p. 27.

No new material of this species has been taken in recent collections made on Hispaniola. The new figures here presented were prepared from the lectotype.

Material: Dominican Republic, Loma Rucilla, 5–10,000 feet elevation, June 1938, Darlington, ♂ lectotype, ♂ lectoparatype (MCZ). Valle Nuevo, southeast of Constanza, c. 7,000 feet elevation, August 1938, Darlington, ♂ lectoparatype (MCZ).

Polycentropus jeldesi, new species

Figures 9–10

This species is a member of the nigriceps group, most closely related to *P. domingensis* Bks. *P. jeldesi* is easily recognized by the lack of a well developed ventrobasal flap and reduction of the apicomesal flap of the outer cercal lobe, as well as the shorter inner lobe of the cercus. The form of clasper, especially its dorsal appendage and vertical support, is also distinctive in the two species.

I am pleased to dedicate this species to Dr. Fidel Jeldes of the Universidad Autonomia de Santo Domingo who aided me during my collecting trip to the island.

Adult: Length of forewing, 8 mm. Color brown; legs and venter stramineous, head fuscous dorsally; forewing brown with many small spots of golden hair scattered overall. Male genitalia: Ninth segment with slightly sinuate anterior margin, arising directly from anteromost connection of cercus. Tenth tergum lightly sclerotized ventrally, with ventromesal lobe short. Cercus 2 lobed: inner lobe slender, nearly straight, shorter than outer lobe; outer lobe enlarged basally, curved, with a small apicomesal flap and bearing ventromesally, short, broad spines. Clasper with dorsal appendage long, decurved apically; vertical support with posterior margin bearing a short spine; ventral lobe elongate. Aedaegus lightly sclerotized, with an internal tubular sclerite hooked apically.

Material: Holotype, male: Dominican Republic, Convento, 12 km. south of Constanza, 6–13 June 1969, Flint & Gomez. USNM type 73737.

Polycentropus marcanoi, new species

Figures 11–12, 18

This member of the nigriceps group is a very close relative of *P. jamaicensis* Flint. From *jamaicensis*, *marcanoi* differs in the longer, more evenly curved lateral lobe of the cercus, and in slight differences in the shape of the clasper.

I dedicate this species to Professor Eugenio de Jesus Marcano F., who aided both me and the Davises during our collecting trips to Hispaniola.

Adult: Length of forewing, male 6–7 mm., female, 8 mm. Color dark brown; legs stramineous, head fuscous dorsally; forewing brown, with many small spots of golden hairs scattered overall. Male gentalia: Ninth segment with anterodorsal angle evenly rounded, anterior margin nearly straight. Tenth tergum sclerotized ventrally with a long ventromesal lobe. Cercus 2 lobed; inner long, tip slightly curved mesally, with inner face bearing a short spinous process; outer long (surpassing inner lobe), arched, mesoventral face bearing a region of broad, flattened spines. Clasper with dorsal appendage arched, not surpassing vertical support which bears a small apicodorsal hook; ventral lobe only slightly longer than vertical support. Aedeagus lightly sclerotized with central tubular sclerite hooked apically. Female genitalia: Lateral lobes of eighth sternum broad, tapering apically. Ninth sternum trilobate posteriorly. Vagina with a lateral pocket-like sclerite, mesad of which is a small quadrilateral sclerite, basally with a rounded sclerite bearing a rimmed central opening.

Material: Holotype, male: Dominican Republic, Dajabon Prov., 13 km. south of Loma de Cabrera, 400 m. elev., 20–22 May 1973, D. & M. Davis. USNM type 73738. Paratypes: Same data, 4♂ 1♀. La Estrella Prov., 4 km. southeast of Rio Limpio, 760 m. elev., 24–25 May 1973, D. & M. Davis, 3♂. El Seibo Prov., 15 km. south of Miches, 500 m. elev., 31 May 1973, D. & M. Davis, 1♂.

Polycentropus jamaicensis Flint

Figures 13–14, 17

Polycentropus jamaicensis Flint, 1968a, p. 25; 1968b, p. 80.

This species is known only from the island of Jamaica. No material has been seen beyond that recorded in the original description.

Polycentropus species 1, probably *nigriceps* Banks

Figure 15

This female from Cuba would seem, of necessity, to be that of *nigriceps*. However, the possibility of undescribed species is ever present, and for this reason I do not feel absolutely certain of the association.

Adult: Length of forewing, 7 mm. Color brown; mostly denuded, but apparently similar to that of other species of the group. Female genitalia: Lobes of eighth sternum elongate, narrowed at midlength with apices markedly narrowed. Ninth sternum trilobate, with lateral lobes directed posteriad and with anterolateral angles produced and strongly sclerotized. Vagina lightly sclerotized with a pair of contiguous plates mesally, with pouchlike sclerites indistinct and produced into rounded anterolateral lobes; anteromesal rounded sclerite with a central, rimmed opening.

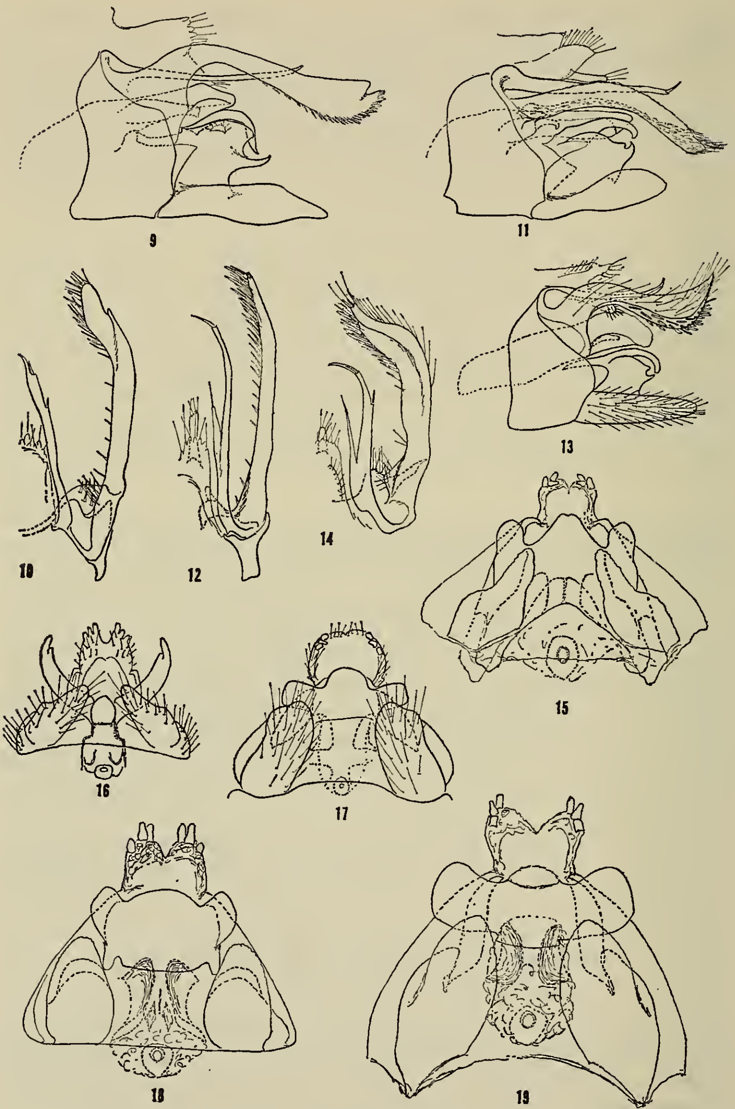
Material: Cuba, Pinar del Rio, S. Cajalbana, June 1956, F. de Zayas, 1♀ (INHS). Trinidad Mts., Mina Carlota, 24 Mar. 1925, Geo. Salt, 1♀ (MCZ).

Polycentropus species 2, possibly *jeldesi* Flint

Figure 19

This series of females was collected in association with one male each of *P. jeldesi* and *P. vanderpooli*. However, on the basis of the similarity in genitalia to *P. jamaicensis* it would seem most likely that they are the females of *jeldesi* which is more closely related to *jamaicensis* than to *vanderpooli* which seems much less closely related.

Adult: Length of forewing, 9–11 mm. Color as in *jeldesi*. Female genitalia: Lobes of eighth sternum ovoid, elongate, with anterolateral angle produced. Ninth sternum trilobate, with lateral lobes longer than wide, mesal lobe not sclerotized. Vagina bearing a pair of rounded,



Figs. 9–19. Male genitalia lateral, tenth tergum and cercus, right side dorsal, respectively of *P. jeldesi* n. sp. 9–10, *P. marcanoi* n. sp. 11–12, *P. jamaicensis* Flint 13–14. Female genitalia ventral of *P.* species 1 15, *P. zaneta* Denn. 16, *P. jamaicensis* Flint 17, *P. marcanoi* n. sp. 18, *P.* species 2 19.

pouch-like lateral sclerites, and anteromesally a rounded sclerite bearing a rimmed opening.

Material: Dominican Republic, Convento, 12 km. south of Constanza, 6–13 June 1969, Flint & Gomez, 6♀.

PHYLOGENY

As has been mentioned previously, the nigriceps group is clearly monophyletic. There are several synapomorphic characters which unite the group: the presence of a fingerlike appendage dorsally on the clasper, a thin, vertical plate which supports this appendage and is united to the ventral lobe, and finally in the females the apex of the ninth sternum is trilobed.

An inspection of the known *Polycentropus* species from Mesoamerica, South and North America, and a more superficial survey of the Old World species does not uncover any other species of this group. The species, *P. insularis* Bks., the single known congeneric species from the Lesser Antilles, is clearly a sister species of *P. altmani* Yamamoto, known from southern Central and northern South America. It is no way directly involved in the nigriceps group.

The Nearctic group of species centered on *P. confusus* Hag. would appear to be the only group presently known that might bear a relationship to the nigriceps group. The ninth segment lacks a dorsal connection in the two groups. The tenth tergum is membranous with a pair of submesal process in both although the processes are longer in the confusus group. The cerci of the two groups are comparable although superficially very distinctive. Both consist of a long rodlike inner lobe which is greatly displaced mesad and partially separated in the nigriceps group. The outer lobe is barely developed in the confusus group but a large separate lobe in the nigriceps group. The claspers are also comparable in the two groups. Both have similar ventral lobes, and support for a dorsal appendage. However, the shapes of the supports and dorsal appendage are quite different in the two groups. Finally the aedeagus is a rather simple tubular structure in the two, without especially complex internal sclerites.

In the female genitalia there is less in common. However, the ninth sternum is an elongate lobe, rounded apically in the confusus group, from which it is not too difficult to develop the trilobed apex of the nigriceps group.

The nigriceps and confusus groups, then, are probable sister groups. Within the nigriceps group, I would consider *nigriceps* to be the closest to the ancestral form. The following characteristics appear to be pleisiomorphic: a mitten-shaped outer lobe of the cercus, an unornamented, vertical posterior margin of the dorsal support of the clasper, with a short posterior extension of the dorsal appendage. *P. nigriceps* has developed a specialization in the form of a heavily sclerotized ventral lip on the aedeagus.

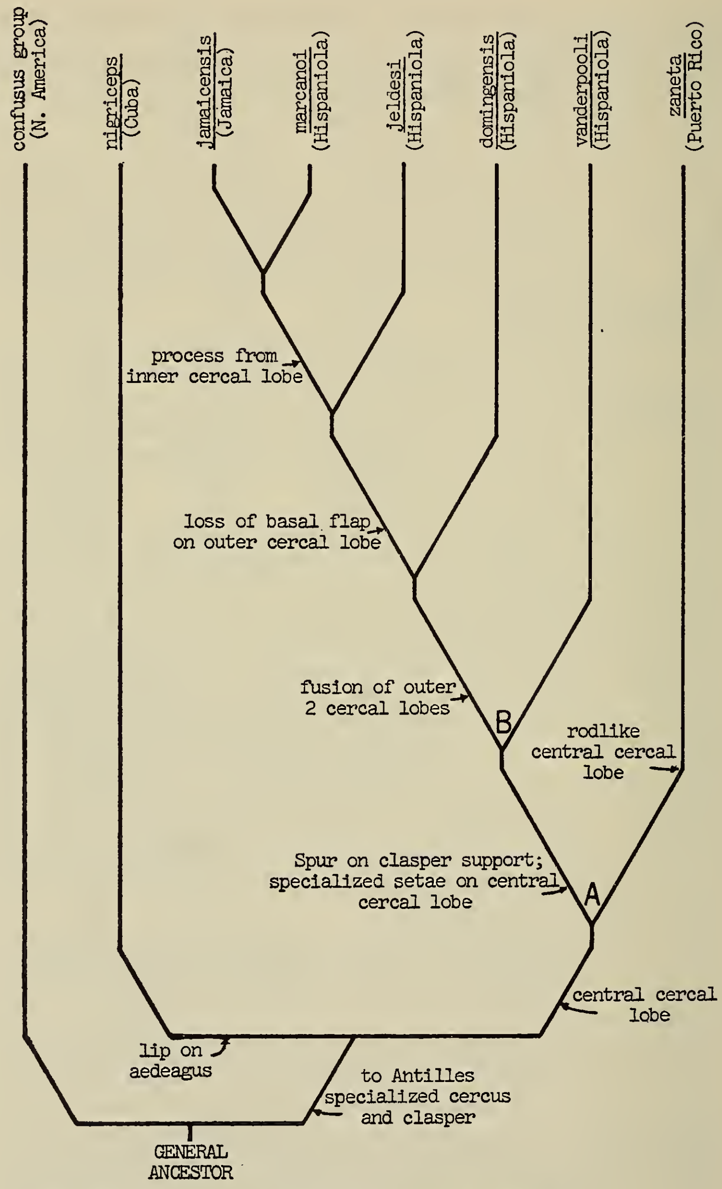

confusus group (N. America)
nigriceps (Cuba)
jamaicensis (Jamaica)
marcanoi (Hispaniola)
jeldesi (Hispaniola)
domingensis (Hispaniola)
vanderpooli (Hispaniola)
zaneta (Puerto Rico)
process from inner cercal lobe
loss of basal flap on outer cercal lobe
fusion of outer 2 cercal lobes
B
rodlike central cercal lobe
Spur on clasper support; specialized setae on central cercal lobe
A
central cercal lobe
lip on aedeagus
to Antilles specialized cercus and clasper
GENERAL ANCESTOR

DIAGRAM 1. Phylogenetic tree of the nigriceps group.

From this stage two apomorphic conditions developed in Ancestor A: first, a third, central lobe arose between the inner and outer lobes of the cercus; and, second, the dorsal appendage of the clasper elongated posteriorly. *P. zaneta* appears to be a descendant from Ancestor A. From this ancestor the central lobe of the cercus has become specialized into a long, rodlike process.

The descendant of A, Ancestor B, has specialized in the modification of the setae on the central lobe of the cercus into flattened, shortened setae, and the development of a spine from the posterior margin of the vertical support of the clasper. *P. vanderpooli,* possessing these characteristics, would appear to be a direct descendant of Ancestor B.

After Ancestor B there is a phenocline in the evolution of the outer and central lobes of the cercus. This begins with the fusion dorsobasally between these lobes. As the fusion continues apically, the resultant lobe lengthens and soon equals and then surpasses the inner lobe in length. One early stage is shown by *P. domingensis* in which the basal flap of the outer cercal lobe is still present and the apices of the two lobes are not completely fused. However, the ventromesal face of the fusion lobe bears a long band of the specialized, flattened setae originally found on the central lobe. The next stage is represented by *P. jeldesi,* which has lost the basoventral flap of the outer lobe of the cercus, and the fusion of the outer and central lobes has proceeded further, but the central lobe still projects from the apex mesally.

P. marcanoi and *P. jamaicensis* represent the ultimate stage and are clearly sister species. They share two apomorphic characters. First, the inner lobe of the cercus has developed a small inner spinous process. The second characteristic is the process on the posterior margin of the vertical support in the clasper which has been reduced in size and moved dorsad, becoming a small hook approximate to the tip of the dorsal appendage. From this point each species has specialized slightly in the structure of the outer lobe of the cercus.

DISPERSAL

Assuming that the confusus group, which is limited to eastern and central North America, and the nigriceps group, which is limited to the Greater Antilles, are sister groups, then the form ancestral to both must have been widespread in North America including Mexico. This ancestral form may have entered the proto-antillean islands, probably a member of the Cuban complex, in early Tertiary times through nuclear Central America (cf. Malfait & Dinkelman, 1972). In support of this hypothesis, *P. nigriceps,* the most primitive member of the group, is presently found on Cuba.

Afterwards, dispersal would have proceeded down the chain of islands, with ancestral form A becoming widespread. One of the descendants of this form has remained on Puerto Rico and resulted in *P. zaneta.*

The other descendant of Ancestor A, Ancestor B, must have been

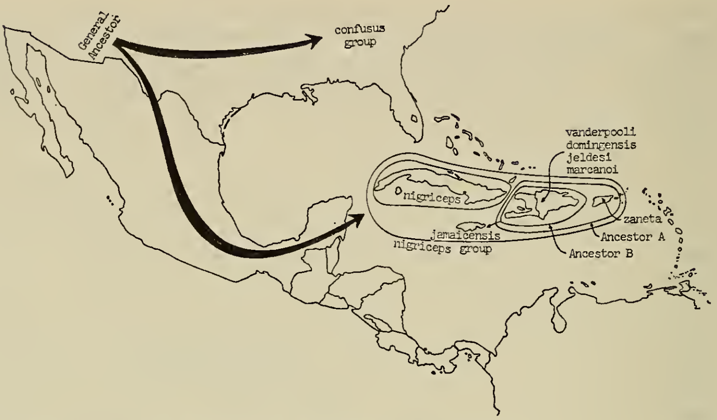


Diagram 2. Distribution of the nigriceps group.

isolated in the Hispaniolan region, where it underwent a long evolutionary history, with *P. vanderpooli*, *P. domingensis*, and *P. jeldesi* marking various steps. Undoubtedly much of this evolution must have occurred in comparative isolation on various proto-islands and/or mountain ranges during the ensuing geological periods, with the present island form uniting these entities.

It is difficult to understand why a similar geological history on Cuba has not produced a similar swarm of species. Perhaps further collecting will uncover such species.

In comparatively recent times the form ancestral to *P. marcanoi* and *P. jamaicensis* must have dispersed from Hispaniola to Jamaica, thus completing the presently seen pattern of distribution on the Greater Antilles.

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